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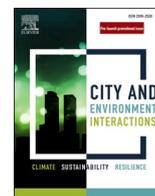
Unpacking SDG target 11.a: What is it about and how to measure its progress?

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ABSTRACT

The pivotal role that urbanisation plays in global development trajectories is clearly acknowledged by the United Nations 2030 Agenda that, among its 17 Sustainable Development Goals, explicitly argues in favour of cities and human settlements to be more inclusive, safe, resilient and sustainable (SDG11). Whereas SDG11 targets are paired with one or more indicators to monitor their achievement, in some cases this process is not straightforward. In particular, when it comes to Target 11.a *Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning*, the identified indicator does not seem able to grasp the complexity of national and regional governance, policy and planning. With the aim to contribute to this concern, the paper conceptually discusses the contents and implications of the SDG11 target 11.a. On this basis, it develops a multi-dimensional set of indicators to assess the quality of spatial governance and planning in a given context, and divides them into three main categories: (i) procedural indicators, (ii) instrumental indicators and (iii) financial indicators. The result of this work is a toolbox that may support decision-makers and policy-makers in assessing the quality of the efforts they put in place to make their cities and territories more sustainable as well as to reflect on what measures and initiatives could make this action more effective.

Introduction

Urban areas and their surroundings have been growing rapidly since the second half of the 20th Century in most regions of the world. In 2008 the urban population surpassed its rural counterpart for the first time in history and recent projections show that it may reach 70% of the world total by 2050 [59]. This urbanisation trend has brought about increasing socio-spatial and environmental inequalities, that manifest with different magnitude in the different countries and regions of the world, and that have been further exacerbated by the recent COVID19 pandemic [17]. The pivotal role that urbanisation plays in global development trajectories is acknowledged by international organizations, that have dedicated time and resources to better understand and manage its implications and pitfalls [9,59]. The most concrete example in this concern is represented by the United Nations 2030 Agenda for Sustainable Development [60]. More in particular, among the 17 Sustainable Development Goals (SGDs) that should provide a shared blueprint towards alternative, more cohesive models of development, through its SDG11 the 2030 Agenda explicitly argues in favour of cities

and human settlements that are more inclusive, safe, resilient and sustainable.

The SDG11 is operationalised through 10 distinct targets, each paired with one or more indicators to monitor progress in its achievement. In some cases, however, this is not straightforward. In particular, when it comes to the Target 11.a *Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning,* only one indicator has been identified, that by no means appears sufficient to grasp neither the complexity of national and regional governance, policy and planning nor the heterogeneity of programmes, instruments and mechanisms that are put in place in the different institutional context to address the economic, social and environmental challenges raised by urbanisation.

In the light of the above, this contribution draws on the results of the research project *QUICHE - What measurements for what policies?* to conceptually unfold the contents and implications of the SDG11 target 11.a and, on this basis, to develop a multi-dimensional set of indicators able to assess the quality of spatial governance and planning in a given context. The proposed set of indicators is subdivided into three main

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categories: (i) procedural indicators – focusing on governance models and institutional coordination; (ii) instrumental indicators – focusing on the differential nature of the instruments that are put in place to address sustainable development and (iii) financial indicators – focusing on the ability to effectively catalyse financial support from existing funding programmes and schemes. On the one hand, its goal is to monitor how different territories perform the SDG11 target 11.a and what actions can be put in place to achieve the target. On the other hand, its main added value lies in its implementation by the regional and local authorities active within those territories and in the innovation that this process may trigger in local policy and decision-making. More in detail, when assessing their performance through the proposed set of indicators, regional and local authorities will engage in a reflective process that enhances their understanding of the otherwise rather blurred meaning of the SDG11 target 11.a, and stimulate them to undertake innovative actions. In this light, the fact that the proposed set of indicators comes nearly halfway through the 15-years implementation period of the UN 2030 Agenda does not constitute a problem, as they will produce an added value not only through monitoring but as a result of their adoption on the ground.[1]

After this brief introduction, the targets that details SDG11 are presented more in detail, and critically reflected upon in the light of the recent literature on the measurement of the impact of public policies. Then the contribution zooms on Target 11.a, and how its nature is intrinsically different from the other targets identified in the SDG11, hence generating many challenges concerning its measurement. To tackle these challenges, Section 4 introduces a set of indicators that, approaching the issues at stake from multiple dimensions, may contribute to its ease in their measurement by local and regional public authorities. Finally, the last section rounds off the contribution, discussing the implications of the proposed solution and pointing out the limits and opportunities of its operationality. Overall, the contribution offers decision and policy-makers a toolbox to assess the quality of the efforts they put in place to make their cities and territories more sustainable, as well as to reflect on what measures and initiatives could make this action more effective.

SDGs, targets and Indicators. The challenge of measuring public policy impact

The latest version of the SDGs framework, published in 2020 by IAEGSDGs (Inter-agency and Expert Group on SDG Indicators), is composed of 17 objectives, divided into 169 targets and 231 indicators. Although improving the original 2015 version, the 2020 version by IAEGSDGs maintains the same aim and approach, globally outlining a set of guidelines that should be useful to locally support sustainable policy and decision-making [2,5]. Within the proposed framework, the targets that detail the 17 SDGs aim both to structure their contents (through the so-called "outcome targets", marked with numbers e.g. 11.1, 11.2, 11.3 etc.), and to increase their operationality (through the so-called "process targets", marked with letters e.g. 11.a, 11.b etc.). Each target is provided with one or more indicators, aiming at facilitating the monitoring of the progress achieved.

The implementation of the SDGs has been widely explored in the academic debate, as highlighted by Nakamura et al. [44]. In particular, several authors have elaborated on the potentials and constraints that characterise the implementation and monitoring of the SDGs, often

referring to and comparing specific national realities [21,40,47,53–55,62]. Among them, a recent contribution from Allen and colleagues aims to "provide practical and actionable evidence that assist countries to understand, quantify, and implement the transformations needed to achieve the SDGs over the coming decade" [4]. Among others, the authors underline the need for an effort in the definition of specific quantitative target values. They rightly argue that SDGs' targets are "aspirational rather than quantified" to give countries the flexibility to "choose their own goal values in lines with global ambition and national conditions" (ibid. p.10). This flexibility intends, on the one hand, to allow domestic actors to choose priority targets based on their contextual specificities and, on the other hand, to identify and select indicators based on the actual data quality and availability.

These indicators are particularly important, as it is through them that the implementation of the SDGs in real-world contexts occurs. As a consequence, large efforts are dedicated every year to refine and ameliorate the measure of these indicators, through the introduction of innovative methodologies and the improvement of data quality and availability. Currently, indicators are divided into three clusters (labelled Tiers) based on their quality. This classification describes, from better (Tier 1) to worst (Tier 3), how the indicators are expected to perform in terms of methodological soundness and worldwide data availability [1]. It also highlights the need to reflect on the quality of the indicators from a multi-scalar perspective, moving from the global scale to a finer scale, since differences between the quality of the available data are the more challenging the closed one gets to the local level. Following this perspective, the global objectives, targets and indicators proposed by the UN 2030 Agenda are further investigated at finer scales by EUROSTAT at the European level and by national statistical institutions at the country level. On one hand, a set of indicators is proposed by EUROSTAT to monitoring the work done by countries and compare them in relation to data quality and adequacy [1].[2] On the other hand, since 2016 national institutions have started to develop frameworks and mechanisms aimed at monitoring the implementation of the UN 2030 Agenda.[3]

When it comes to the local level, cities are recognized as the place where technological, economic, and socio-cultural development can be primarily achieved [38], being at the same time characterised by the highest shares of energy consumption, pollution and social exclusion [10,64–66]. Accordingly, a specific goal of the 2030 Agenda, i.e. SDG11, was set to make cities inclusive, safe, resilient and sustainable. In the 2020 SDGs framework, SDG11 is constituted by 10 targets and 14 indicators (See Table 1). At the global level, the Sustainable Development Solutions Network (SDSN) support the monitoring of the SDG11 achievement through a set of spatial and not spatial indicators: proportion of urban population living in slums; annual mean concentration of particulate matter of less than 2.5 μm in diameter (PM2.5); access to improved water source, piped; satisfaction with public transport; population with rent overburden. A comparative overview of the indicators used to monitor SDG11 at global, European and national levels has been recently compiled by [2] (pg. 16–18). Moreover, numerous contributions exist, specifically devoted to the investigation of SDG11 and the

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[1] As it will be further argued throughout the paper, an additional limit of the proposed set of indicators derives from the fact that their development mostly draws on the European context. As a consequence, while some indicators are more flexible and can be useful to most contexts, others present a 'European bias'. Overall, whereas this may at least partly limit their full operationalisation, in our view it does not prevent the mentioned innovative potential that resides in their adoption and implementation.

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[2] The latest set of indicators has been published in June 2021, and it contains 102 indicators, of which 37 concern more than one target [27].

[3] In Italy, for example, the SDG have been included into the economic, social and environmental programming, through the "National Sustainable Development Strategy 2017/2030" (NSDS) [34]. At the same time, the process that led to the development of the NSDS also contributed to set up a multi-stakeholders platform that contributes, through different initiatives, to ensure its implementation and, in turn, to achieve progress in the achievement of the SDGs and their targets. Moreover, the National Institute of Statistics (ISTAT) regularly provide an informative report monitoring the progess in relation to each SDG. The 2020 ISTAT report proposes 325 national statistical measures to monitor the 130 global indicators considering the specificities of the Italian context [33].

Table 1
The list of Sustainable Development Goals, targets and indcators (Source: [60]).

Goal 11, its targets and indicators	
Targets	**Indicators**
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing
11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	11.3.1 Ratio of land consumption rate to population growth rate 11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically
11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	11.4.1 Total per capita expenditure on the preservation, protection and conservation of all cultural and natural heritage, by source of funding (public, private), type of heritage (cultural, natural) and level of government (national, regional, and local/municipal)
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population 11.5.2 Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities 11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities 11.7.2 Proportion of persons victim of physical or sexual harassment, by sex, age, disability status and place of occurrence, in the previous 12 months
11.a Support positive economic, social and environmental links between urban, *peri*-urban and rural areas by strengthening national and regional development planning	11.a.1 Number of countries that have national urban policies or regional development plans that (a) respond to population dynamics; (b) ensure balanced territorial development; and (c) increase local fiscal space
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels	11.b.1 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 11.b.2 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials	*No suitable replacement indicator was proposed. The global statistical community is encouraged to work to develop an indicator that could be proposed for the 2025 comprehensive review. See E/CN.3/2020/2, paragraph 23*

identification and testing of its targets and related indicators, focusing on different regions of the world. Klopp and Petretta [37] investigated the relationship between indicators, complexity and the politics of measuring cities, highlighting the need to reduce the vagueness of indicators to avoid fuzziness between universal and appropriate local implementation. Similarly, also Hansson et al. [30] highlight the need to reprioritize indicators so that they can provide a higher added value in supporting sustainable development governance. In particular, they suggest that domestic actors should be allowed to choose those targets and indicators "that fulfil the criteria of ease of measurement or collection, appropriateness, convenience and relevance to prevailing conditions and national and local development policies, priorities and programmes" ([30]: p.15). When discussing the preliminary results of a comparative research project focusing on seven cities located in four different continents,[4] also Valencia et al. [61] stress the need for adapting and localising the SDGs targets and indicators, and operations that should be performed together with local policy and decision-makers. They argue that the SDG indicators "do not provide a comprehensive set of metrics to monitor the SDGs. Local governments, then, need to find complementary metrics that can help to plan and better monitor their SDG and New Urban Agenda work. The challenge for local governments lies in finding a balance between a comprehensive set of new indicators (which can include the locally adapted SDG indicators) and using their existing city monitoring frameworks if they exist" ([61], p. 16).

The SDG11, its targets, and the actual operationality of its indicators constitute the focus of the research project *QUICHE – What measurements for what policies?*, that brings together scholars from different Italian Universities (Politecnico di Torino, Politecnico di Milano, University of Padua and Istituto Universitario di Architettura di Venezia) to critically reflect on how the SDG11 targets are measured, and how this measurement can be improved. In doing so, the research team aims to provide the public sector with new indicators, to support their activities in the implementation of the SDG11 through the construction and evaluation of sustainable development policies.[5]

More in particular the project acknowledges that, within the public and political discussion, the relationship between policies and the measurement of their effectiveness and impact is often simplified, considering indicators and their measurement directly and univocally connected with the phenomena and policies analysed. Conversely, this relationship is more complex, both in the case of ex-post policy analyses or ex-ante assessments [67]. Due to this reason, a clear and univocal definition of what is intended with 'indicators' in relation to policy and planning does not exist [32]: depending on the situation, they are defined as descriptive measures, i.e. "a variable that describes the state of a system" [63], or as normative measures, i.e. "index or measurement endpoint to evaluate the health of a system (economic, physical, biological, human)" [12] or more a function of variables, that provides an indication, "an argument of a function used to take a decision" [51]. In other cases, indicators are considered as hybrid measures, descriptively for a scientific purpose or normatively for a political purpose [3], but also as a measurement of quality [28], p. 313. This complexity increases when those indicators are not meant to measure territorial phenomena on the ground, but rather concern the quality of policies. Here, indicators are not only used to describe states or changes but to evaluate

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the system of policies that is in place in a given context to achieve these changes, in so doing aiming at supporting their reflective improvement, in terms of objectives to achieve and of the processes and mechanisms that they encompass [23,50].

This is the case of the SDG11 target 11.a, which aims at strengthening national and regional planning in support of positive economic, social and environmental links between urban, *peri*-urban and rural areas. As it will be further discussed in the following section, the operationalisation of this target raises particular challenges, related to the complexity of the actual spatial governance and planning configuration and dynamics that characterise the different national, regional and local contexts. The complexity surrounding the identification of suitable indicators to measure the progress of SDG target 11.a is further certified by the fact that very few contributions have until now approached this issue in the academic literature and mostly adopted the rather vague indicator developed by the United Nations (e.g.[20,37]).

SDG11 target 11.a: A different animal?

The definition of SDG11 target 11.a *Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning*, concerns many interdepended phenomena, that are however hard to unfold and understand together according to a systemic perspective. At the same time, the approach suggested to measure achievements in its concern appears oversimplified: the target is paired with a single indicator (11.a.1), that refers to the "Number of countries that have national urban policies or regional development plans that (a) respond to population dynamics; (b) ensure balanced territorial development; and (c) increase local fiscal space." This oversimplification is evident when exploring the data gathered about this indicator through the global overview conducted by the UN,[6] which appears rather general and incapable of even scratching the top of the iceberg of the heterogeneity of instruments and practices that allow of addressing territorial development at the regional and local levels (see Fig. 1).

When acknowledging the gap concerning the operationalization of Target 11.a, some questions arise, concerning the methodological soundness of the identified indicator, as well as to the actual possibility to define and further articulate a system of indicators that can do a better service to this task. As already highlighted by the various academic contributions recalled in the section above, and also pointed by UN Statistical Commission, indicators should be further articulated and contextualised within the various individual countries, to adapt to the specificities of the places and the availability of domestic data, human resources and technological facilities [29,41]. In this light, the lack of any relevant reflection on this target at the national level certainly represents a gap that should be addressed to avoid that the important issues subsumed by SDG11 target 11.a are neglected in national and local policy and decision-making. Similarly, to further reflect on possible indicators that may contribute to the operationalisation and monitoring of this target is particularly relevant, especially in relation to the role played by Urban Policies in the implementation of the main global development frameworks in various regions of the world (see: [7]).

More than the other targets that compose the SDG11, target 11.a has a strong policy focus. The interlinkages between different types of territories and their development dynamics matters in relation to the policies that are put in place to influence them – and in particular to the multilevel nature of these policies, the various instruments that they adopt, and the mechanisms that they trigger to produce an impact. Similarly, as stated by Rudd et al. [52], "[t]he goal's promotion of urban-rural linkages (Target 11.a) signals a reinvigorated desire from the international community to move from a dichotomous conception of

urban and rural development to one of mutually reinforcing, synergistic development across the rural-urban continuum. However, such a concept remains quite difficult to translate into tangible policies at all levels of government. Cities still require concrete legislative, spatial, and financing solutions". Hence understanding the combination of territorial institutional dynamics and the administrative structure based on which these territories are organized and managed is of uttermost importance, as their interdependence and the synergies between the actions promoted at the various scale may lead to their actual success (or failure) [19].

In practical terms, any measurement of these dynamics have to come to terms with the fact that each country in the world is characterised by its own spatial governance and planning systems [6,35,36,42,49,68–70], that is pivoted on its administrative system and culture [43], and that has developed and consolidated through time as a consequence of the specific histories and geographies that characterise a particular place [31]. As a consequence, the way decisions are taken, the distribution of competences, the relational mechanisms among planning levels (national, regional, local etc.) are all important aspects to be assessed, as they all together influence the outcome of territorial development – which in turn can favour a more sustainable urbanisation [57], 2021) and increase the quality of life of citizens [24]. At the same time, development policies are delivered on the ground by decision and policy-makers according to many different instruments. Those instruments are also time-contingent and context-dependent, and they can range from more visionary and strategic-oriented tools to programming activities dedicated to the distribution of resources on the ground, up to regulative and normative tools. They can be statutory or non-statutory, mandatory or voluntary, more or less binding for the public and private actors. Finally, their scope may vary widely, as they may concern more holistic and integrated goals or specific sectors (e.g. housing, transport, environment, energy, etc.). Finally, territorial development should be supported by appropriate funding mechanisms. This is particularly important when it comes to implementing spatial strategies and programmes. To ensure that spatial planning tools produce the desired impacts, they should be accompanied by adequate funding frameworks that support the action of public and private actors as well as of the civil society.

Overall, the above suggests how the promotion of sustainable territorial development should take into account procedural, instrumental and financial aspects simultaneously. In this light, it is important that these aspects are given account of in the definition of the system of indicators devoted to the monitoring and implementation of the SDG11 target 11.a. Due to the procedural nature of this target, to do so may, in turn, provide an added value also concerning the implementation of other SDG11 targets and, more in general, to the achievement of the objectives set by the main global development framework. Building on this argument, in the following section the contribution proposes a set of indicators that concerns these three aspects, in so doing aiming at providing decision and policy-makers with a useful reference to reflect on their activity and on how to improve it.

How to monitor and implement SDG11 target 11.a?

As highlighted through the above discussion, SDG11 target 11.a is difficult to implement, and the progress achieved in each context in relation to the latter is hard to monitor due to the lack of a proper system of indicators at the supranational and national levels. Being a process-oriented target, it is difficult to synthesise what kind of phenomena it concerns as well as what kind of indicators can better represent these phenomena. Despite the theoretical and methodological trap that this attempt can bring up, a set of indicators have been conceptualized and are here proposed. As the phenomena that SDG11 target 11.a encompass are very heterogeneous, these indicators are grouped in three categories that concerns the three dimensions sketched out in the section above and reflect the main categories often used as a basis for spatial governance

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[6] Goal 11: Sustainable Cities and Communities - SDG Tracker (sdg-tracker.org)

Urban policies that respond to population dynamics, 2020

Countries which have national urban policies or regional development plans that respond to population dynamics; ensure balanced territorial development; and increase local fiscal space.
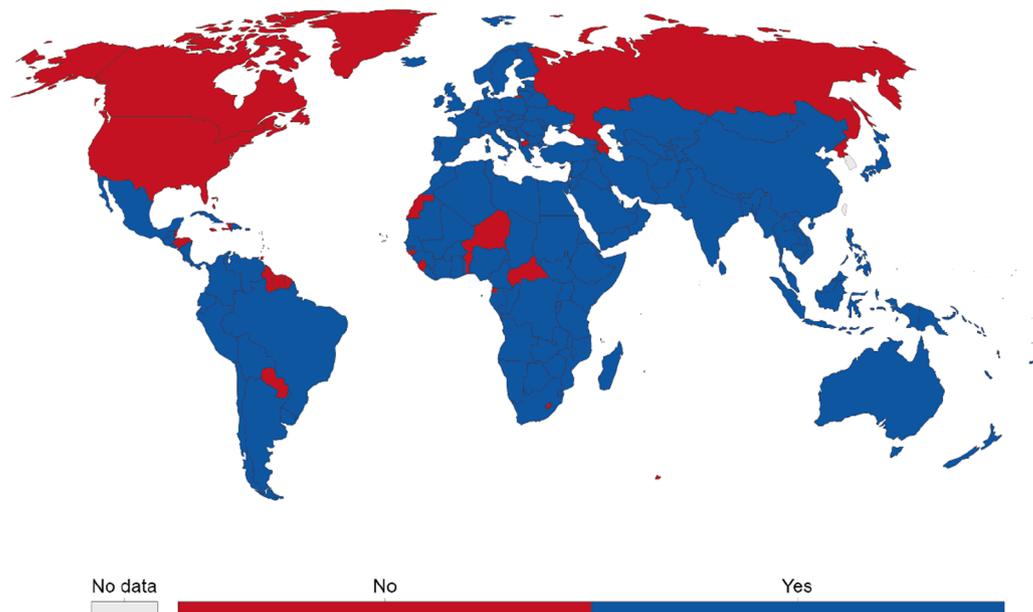

Fig. 1. Countries covered by national urban policies or regional development plans across the world Source: United Nations Huma Settlements Programme, Urban policies that respond to population dynamics, 2020 (ourworldindata.org).

and planning analysis (i.e. governance mechanisms, instruments and resources [42]:

- Procedural indicators – focusing on the governance and institutional coordination mechanisms aimed at territorial development that are identifiable in a given context.
- Instrumental Indicators – focusing on the spatial planning tools, programmes and other types of devices that in one way or another influence territorial development in a given area.
- Financial Indicators – focusing on the various types of economic support activated for the promotion of (sustainable) territorial development in a given context and the ability to access them.

Each of these categories is further unpacked in the subsections below, in order to showcase more in detail the identified indicators. Overall, the 15 indicators listed below aims at providing regional and local institutions with an articulated toolbox that can be further adapted and refined as a consequence of the specific contextual features and needs as well as of the availability of data. As local public authorities can hardly dedicate a large number of human resources and technological facilities to the acquisition of the data that are necessary to measure all the proposed indicators, if this information has not been already

collected, the complete list is intended to allow them to work on those that are most relevant for their territory and to aim funds and resources on the acquisition of the useful data. In this light, policy and decision-makers in a given context are not required to use all the proposed indicators, they should rather select those that are more appropriate and easy to use in relation to their needs and priorities, in turn facilitating the monitoring and assessment process without compromising their capability to collect data and complete the self-evaluation.

Another important specification concerns the scale of measurement. The specific administrative configuration that characterises each country does not allow the univocal definition *a priori* of the correct scale of monitoring. To solve this problem, two main scales are proposed, i.e. the municipality scale, and the regional scale. On the one hand, the municipality scale measures the number of interactions, instruments or the magnitude of attracted funds that characterise a single municipality. On the other hand, the regional scale considers the total number of cooperation initiatives, instruments or resources that characterise the municipalities of a given region. Additional scales can be adopted in parallel to the regional scale – for instance, the scale of a province, a county or a metropolitan city, or even a whole country – when a country features additional administrative subdivisions that may be interesting to investigate.

Importantly, the proposed set of indicators is intended to serve a twofold use. First of all, public authorities can use them, following the suggestions provided above, to monitor the quality of their action in relation to the implementation of SDG11 target 11.a *in itinere*. Secondly, policy and decision-makers are invited to engage with the proposed indicators when programming their action, as a reference in support to critical self-assessment that, in turn, stimulates innovation in the definition of territorial priorities and instruments to be implemented in the future.

Before presenting the indicators more in-depth, a final disclaimer should be brought forward, concerning the potential European bias that characterises the proposed approach. The proposed set of indicators has been developed mostly drawing on European experiences. As a consequence, while some of them concern rather overarching issues, hence being more flexible and adaptable to most contexts, some others are more specifically focusing on issues that are more easily related to the European context (e.g. the financial indicators, focusing on economic programming and support and that were specifically conceived to measure the ability to attract resources delivered through the EU cohesion policy [15,16]). In this light, when adopting the proposed toolbox, policy and decision-makers are invited to carefully ponder what indicators better adapt to their context, discarding or further contextualising those that are considered less relevant or scarcely applicable. Overall, as the main added value of the developed system of indicators resides in the innovative potential that can disclose in their critical adoption and implementation, also this fine-tuning exercise may produce useful results.

Procedural indicators

The first group of indicators concerns inter-municipal cooperation and coordination in various fields (spatial governance and planning, provision of services of general interest etc.), an activity that is generally deemed as essential to strengthen urban-rural relations [13,46]. It is composed of three sub-categories (Table 2): (i) indicators referring to formal cooperation mechanisms; (ii) indicators concerning functional relations and, (iii) indicators concerning goal-oriented coordination processes. Per each indicator, Table 2 will give a brief description of its operationalization, the unit of measurement, the scale of analysis and whether to maximize or minimize.

The first sub-category refers to formal cooperation and coordination. They use the formal governance and institutional networks that characterise a given territory as a proxy of its potential to support economic, social and environmental interlinkages between urban, *peri*-urban and rural areas. In doing so, it concerns those institutional agreements that organise the formal interaction of municipalities (e.g. the participation to mountain unions, or formalised river basin unions, or territorial integration areas etc. (See [14] for further details).

The second sub-category concerns the existence of specific functional conditions that characterize different municipalities, that may share similar social, economic, cultural or geographical features [8]. Examples of these relationships among municipalities are Functional Urban Areas (FUA), Greater cities, coastal or mountain tourist areas, river basins etc.[7] A FUA is a statistical-based territorial delimitation that aggregates geographically contiguous territorial units that share certain common spatial, social and territorial features, as, for instance, a city and its commuting area [22,26]. Similarly, the concept of Greater City also refers to the supra-municipal scale and indicates a territory where the high-density cluster is not limited to the municipality level but is distributed among a set of municipalities. Importantly, these functional relations do not automatically imply the existence of formal agreements among local governments. However, due to their very nature, cooperation and coordination mechanisms within functional territories can be more effective, hence worth investigating.

The third sub-category of indicators, i.e. those concerning goal-directed coordination activities refers to the project-based cooperation and coordination among municipalities, that are instituted to participate in strategic initiatives or projects, to apply to funding schemes or to jointly manage the provision of selected services (e.g. services of general interest [39]). These activities are less structured than those introduced in the first-sub-group and are most often limited in time and scope.

All together, these three sub-groups of indicators aim at comprehensively monitoring the 'density' of cooperation and coordination activities that are ongoing in a given territory, and that, in turn, may contribute to support positive economic, social and environmental links between urban, *peri*-urban and rural areas, as specifically indicated in SDG11 target 11.a.

Instrumental indicators

The second group of indicators focuses on the spatial planning activity that characterises a given context, and in particular, on the nature of the instruments used there, which can be either mandatory or voluntary [56], 2020).

With mandatory instruments, we refer to those instruments that are statutorily established by the law and whose preparation and adoption by local authorities is compulsory. They may be more regulative or strategic in nature, more comprehensive or sectoral, or even focusing on resource programming [42]. On the other hand, with instruments adopted voluntarily, we refer to those instruments that are produced by a specific territorial authority on its own initiative or as a consequence of specific incentives, despite the fact their preparation is not compulsory in the legal framework. More in detail, often local authorities develop and adopt strategic planning documents in order to address territorial development. Those instruments, which may be more or less sectoral or integrated, are in principle non-binding, they rather represent a sort of political manifesto that local actors can adopt to jointly develop a vision for development and further orient future policy and decision-making. This category encompasses all those instruments that are not mandatory and/or statutorily established, as, for instance, local strategic plans but also those instruments that derive from the more or less incentivised adoption of frameworks established at the higher levels (i.e. the Agenda 21 introduced in 1992 at the UN Rio de Janeiro, the Sustainable Energy Action Plans introduced by the European Covenant of Mayors, the Urban Sustainable Mobility Plan, the Action plan for sustainable energy and climate, the Plans for the elimination of architectural barriers etc.).

For each of the different types of instruments, a set of indicators have been elaborated (Table 3). For each of them, the scale of assessment can be either the municipality (i.e. referring to the number of instruments adopted by a given local authority) or the region (i.e. referring to the number of instruments adopted by local authorities belonging to a given region or another supralocal unit).

Financial indicators

The third group of indicators concern the ability of territories to attract resources from external funding programmes activated in support of territorial development (Table 4). The main example in this concern is represented by the EU cohesion policy that, through the delivery of a large amount of resources dedicated to territorial development, support the action of national, regional and local authorities in all European countries (see [18]). However, numerous supranational frameworks exist that deliver resources for territorial development (e.g. selected programmes run by the United Nations, the World Bank or the International Monetary Funds, several bilateral cooperation between countries from the Global North and the Global South, etc. See: [11,48] and various national governments at different stages predispose

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[7] A detail classification of existing functional areas and regions in Europe has been recently developed by the ESPON project FUORE – Functional Urban Areas and Regions in Europe [25].

Table 2

Indicators to monitor formal, functional and goal-oriented coordination and cooperation.

Set of Procedural indicators						
	Code	**Name**	**Description**	**u.m.**	**min/ max**	**Scale**
Formal Cooperation	11. a.1[1]	Number of municipalities in formal interaction with a given municipality.	Indicator 11.a.1 shows with how many other municipalities a given municipality interacts, indicating the magnitude of its cooperation with neighbours (e.g. a municipality that is part of a mountain union composed of 7 municipalities has 6 interlinkages).	*N°*	max	Municipality
	11. a.2[2]	Number of formal interactions in a given region, over the number of municipalities	Indicator 11.a.2 shows how many formal interactions characterise a region, calculated over the number of municipalities it includes (e. g. a region featuring 4 mountain unions and 3 other municipal unions scores 7).	*N° / municipalities*	max	Region (and other supralocal scales)
	11. a.3	Number of shared services[3] over total number of services provided by a municipality	Indicator 11.a.3 considers the share of services as a proxy of goal-oriented cooperation projects among municipalities. More specifically, it examines how many services the analysed municipality provides in cooperation with other municipalities, overthe total number of services provided by this municipality.	*N° shared services / N° total services*	max	Municipality
Functional Relations	11. a.4	Number of municipalities in functional interaction with a municipality	Indicator 11.a.4 shows how many municipalities are in functional interaction with the analysed municipality, as a proxy of potential cooperation with neighbours (e.g. a municipality belonging to a FUA counting 20 municipalities has 19 interlinkages).	*N°*	max	Municipality
	11. a.5	Number of functional interactions in a given region, over the number of municipalities	Indicator 11.a.5 shows how many functional interactions characterise a region, calculated over the number of municipalities it includes (e. g. a region hosting 2 FUAs and a functional river basin scores 3).	*N° / municipalities*	max	Region (and other supralocal scales)
Goal-oriented Coordination	11. a.6[4]	Number of municipalities involved in strategic planning initiatives, international cooperation initiatives and/or twinning in a given region, over the number of municipalities	Indicator 11.a.6 considers the number of strategic planning initiatives, international cooperation initiatives and twinnings that the municipalities in a given region / participate in, calculated over the number of municipalities that region includes.	*N° / municipalities*	max	Region (and other supralocal scales)
	11. a.7[5]	Number of strategic planning initiatives, international cooperation initiatives and/or twinnings to which a given municipality participates, over population size	Indicator 11.a.7 considers the number of strategic planning initiatives, international cooperation initiatives and twinnings to which a municipality participates, calculated over its population size	*N° / people*		Municipality

[1] The interactions measured through indicators 11.a.1 and 11.a.2 can be further refined by multiplying all detected interlinkages for an adjusting coefficient α (through the formula $\sum N^*\alpha / people$), which refers to population size related to the municipalities interacting with the one under investigation, in so doing giving account of their relative weight.

[2] The interactions measured through indicators 11.a.3 and 11.a.4 can be further refined by multiplying each detected interaction for the number of municipalities (belonging to this region) that it includes, hence providing a clearer picture of the number of active municipalities over the total number of municipalities of the region.

[3] The types of services provided by a municipalities varies from country to country according to the specific competences attributed to local governments by the various constitutional and legal frameworks. Due to this reason, the total number of services provided by each municipality should be defined case by case. The definition of Services of General Interest and of Services of General Economic Interest may provide a useful support in this concern (see: [39,45]).

[4] Given the varying time horizon of the initiatives they measure, Indicators 11.a.6, 11.a.7 and 11.a.8 should be calculated for a time-period corresponding to the length of a local government manadate.

[5] The indicator 11.a.7 can be further refined by multiplying each detected initiative for an adjusting coefficient α (through the formula $\sum N^*\alpha / people$), weighting the participation to the initiative in relation to the role played by the municipality within the latter (e.g. $\alpha = 1$ when the municipality leads the initiative and$\alpha = 0.5$ when the municipality participates as a partner).

Table 3

Indicators monitoring spatial planning instruments.

Set of Instrumental indicators						
Type	Code	Name	Description	u.m.	min/max	scale
Mandatory Instruments	11.a.8	Number of mandatory instruments adopted within a given region, in coherence with the number of instruments envisage by the law	Indicator 11.a.8 measure the volume of the mandatory planning activity in a given region, intended as the number of mandatory instruments adopted over the total number of instruemnts that should have been adopted according to the law.	N°/ N° max	max	Region (and other supralocal scales)
	11.a.9[1]	Number of mandatory instruments adopted after the introduction of the SDGs (2015) in a givern region	Indicator 11.a.9 explores whether the introduction of the SDGs in 2015 represented a turing point in the planning activity in a given region. Moreover, it assumes that instruments adopted after 2015 somehow reflect the SDGs framework, hence acting as a proxy of the coherence of the planning activity in a given region with the latter.	N°	min	Region (and other supralocal scales)
Voluntary Instruments	11.a.10	Number of voluntary instruments adopted by a municipality or within a given region	Indicator 11.a.10 measure the volume of the voluntary planning activity of a municipality or a within a territory, intended as the number of voluntary instruments adopted by a given municipality or by all municipalities located within a given region	N°	min	Municipality / Region (and other supralocal scales)
	11.a.11	Number of voluntary instruments adopted after the introduction of the SDGs (2015) by a municipality or within a given region.	Indicator 11.a.11 explores whether the introduction of the SDGs in 2015 represented a turing point in the voluntary planning activity of a given municipality or within a given region. Moreover, it assumes that instruments adopted after 2015 somehow reflect the SDGs framework, have acting as a proxy of the coherence of the planning activity of a municipality or within a given region with the latter.	N°	min	Municipality / Region (and other supralocal scales)
	11.a.12	Number of sectors covering by the voluntary instruments adopted by a given authority	Indicator 11.a.12considers the number of sectors covered by all the voluntary instruments adopted by a given authority.	N°	min	Municipality / Region (and other supralocal scales)

[1] The indicator 11.a.9, 11.a.10 and 11.a.11 can be further refined by multiplying each identified instruments for an adjusting coefficient α (through the formula $\sum N^*\alpha$) that weight it in relation to its scale and, in turn, its ability to promote territorial coordination at a higher level (e.g. $\alpha = 1$ for national and subnational instruments and $\alpha = 0.3$ for municipal instruments).

Table 4

Indicators monitoring the ability to attract external public resources for territorial development.

Set of Financial indicators					
Code	Name	Description	u.m.	min/max	scale
11.a.13	Total funds per capita attracted by a given municipality	Indicator 11.a.13 measures the total amount of public funds that a given municipality has been able to attract from external sources, calculated over its population size.	Σ of funds/ population	max	Municipality
11.a.14	Total Funds per-capita attracted within a given region	Indicator 11.a.14 measures the total amount of public funds that all the municipalities located within a given region have been able to attract from external sources, calculated over the region's population size.	Σ of funds/ population	min	Region (and other supralocal scales)
11.a.15	Number of projects per capita (with an explicit territorial dimension) funded through external resources	Indicator 11.a.15 measures the number of projects characterised by an explicit territorial dimension, that have been funded through external public resources in a given municipality or region, calculated over its population size.	N°/ population	min	Municipality / Region (and other supralocal scales)

financial schemes to which lower authorities can apply to consolidate their budgets through additional resources.

Overall the ability to attract external funds from these schemes is crucial for the pulic authorities at subnational and local levels, as they are often characterised by rather low budgets that, in many areas of the world, have been subjected to progressive cuts as a consequence of the global economic crisis that stroke at the edge of 2010 [58]. As a consequence, external resources often represents a large share of the total funds employed by a municipality or a region for the promotion of territorial development and their magnitude affect greatly their capacity

to support positive economic, social and environmental links between urban, periurban and rural areas, as addressed by the SDG11 target 11.a.

Discussion and conclusions

The paper unfolded the SDG11 target 11.a, to understand more in-depth its nature, role and implications towards a more sustainable territorial development of cities and regions. At present, the target is not provided with any functional indicator deputed to its measure. This is consequence of the fact that it does not concern territorial development

phenomena as such, but those processes of territorial governance and spatial planning that are responsible for addressing and steering these phenomena as well as the interactions among the various policies and instruments that are in place to achieve sustainable territorial development. To fill this gap at least partially, the contribution brought forward a set of indicators that further define the boundaries of the SDG11 target 11.a from a multi-dimensional perspective, by taking into account its procedural, instrumental and financial implications. Overall, these indicators aim to provide policy and decision-makers at the local, regional and national level with an operative tool for monitoring their action in *supporting positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning*. At the same time, they should stimulate the reflective self-assessment of this action, in so doing contributing to trigger innovation in policy and decision-making.

In this light, the role that the proposed list of indicators plays is twofold. On the one hand, and more generically, it provides an articulated, multi-dimensional picture of the processes that SDG11 target 11.a encompasses. On the other hand, and perhaps more importantly, it provides the public authorities at the different levels with a diversified set of measurement options, that they can further adapt and fine-tune as a consequence of the specific contextual features as well as of the actual availability of data.

Aware that technological facilities, human resources and data availability largely differs from one context to another, the future step of the presented research will concern the application of the developed set of indicators to different real-world contexts. This will allow to understand more in-depth the value and benefit of the developed toolbox, and its potential in both supporting the monitoring of the progress achieved about the SDG11 target 11.a and in stimulating critical and innovative thinking in the local authorities that will engage with this activity. At the same time, this real-world application will contribute to highlighting the limits of the proposed indicators in relation to their contextual dependence, European bias and actual flexibility and customisation. More in detail, by testing and assessing the applicability of the indicators through different case studies, it will be possible to adapt and further refine the proposed toolbox and to develop more precise instructions on how to use it, in so doing turning it into useful instruments for policy and decision-makers.

Overall, this contribution represents a first attempt to operationalize the SDG11 target 11.a, through the definition of a monitoring tool that may be useful to policy and decision-makers in assessing the quality of the efforts they put in place to make their cities and territories more sustainable as well as in defining innovative measures and initiatives to make this action more effective.

CRediT authorship contribution statement

Erblin Berisha: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Caterina Caprioli:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Giancarlo Cotella:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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